

Exeltech's 1000 Watt Sine Wave Inverter



Things that Work!
tested by *Home Power*

Tested by Richard Perez, Bob-O
Schultze, and Sam Coleman

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We have been running all of *Home Power's* computer equipment on this Exeltech true sine wave inverter for the last seven months. This inverter produces the purest sine wave power that we have ever measured in any inverter. This inverter delivers sine wave electricity that is cleaner and more reliable than any utility can provide!

The Exeltech SI 1000 Inverter

This inverter takes 12 Volt DC power and converts it into 120 vac, 60 Hz, true sine wave electric power just like the power company rents out downtown, only cleaner. Physically the inverter is tiny in relation to its output power. The SI 1000 measures 8.75 inches wide by 7.75 inches deep by 6.5 inches tall. It weighs a scant ten pounds.

This particular model accepts 12 VDC as input power. Maximum operating voltage is 17.5 VDC and minimum is 10.2 VDC — the widest operating window of any 12 VDC inverter I know. This wide window makes Exeltechs compatible with alkaline battery technologies like nickel-cadmium and nickel-iron. Exeltech also makes inverters which accept 24, 33, 36, 48 or 120 VDC as input power.

Output power of the SI 1000 is rated at 1,000 watts continuous and surge wattage is rated at 2,360 watts. Exeltech makes sine wave inverters from 250 watts to 5000 watts output in all the input voltages listed above.

The inverter is internally protected against overvoltage, undervoltage, overtemperature, and output short circuit. The inverter's input is internally fused which also protects it against reverse input polarity.

Installation

I installed the SI 1000 in Home Power's main system in June 1993. Here it feeds from our main battery of 150 NIFE HIP-10 nickel-cadmium cells (1,500 Ampere-hours at 12 VDC). The SI 1000 is connected to the Ananda Power Center with two 0 gauge copper cables with a combined length of five feet. The input lugs on the larger (1000 watts and greater) inverters will accept 0 to 4/0 gauge cable. The Ananda is equipped with a Deltech 500 Ampere, 50 milliVolt shunt for measuring the inverter's input current. The inverter is protected by a 400 Ampere fused disconnect built into the Ananda Power Center. Installation was simple. The SI 1000 is small enough for wall mounting, so I attached it to the power room wall next to the Ananda.

This Exeltech 1000 watt inverter has been powering our office and home for seven months. The only loads not operated on the SI 1000 are the laser printer, which with all the computers also running is too large for the SI 1000, and Therese's 1500 watt toaster oven. We have been leaving this inverter up all night, running a variety of electronics that demand 24 hour-a-day power (i.e., VISA/MC machine, cordless phone, and FAX).

Inverter Performance

We have been publishing *Home Power Magazine* for the last six years. During this time all of our computer equipment has been powered by solar energy via an inverter. We have operated eight different computers and a fleet of peripherals — everything from laser printers to 35 mm color slide scanners to 1.2 gigabyte hard drives. We have used seven different inverters over the years to power not only our office, but our home. Of all these inverters, this Exeltech SI 1000 has produced the cleanest and most stable power.

Since we have been powering our computer equipment with sine wave power, we have had much more reliable operation. Gone are system crashes, weird printouts, and dancing glitches on the monitors. Gone is the buzz on the TV, stereo, radiotelephone, FAX, and answering machine. All of our inductive loads, like the microwave and all motors, run quieter, faster, and cooler.

After seven months of 24 hour-a-day sterling performance, I decided it was time to break out the instruments and do some serious testing on the SI 1000. I called on Bob-O Schultze and Sam Coleman to lend a hand.

Testing Exeltech's SI 1000 inverter

Bob-O brought his monster mogul base lamp bar up to our system on Agate Flat. This lightbar has switched outlets for five incandescent lamps (25 watts to 1250 watts). All measurements were made with the inverter powering these resistive loads. We used a Beckman

2020 and four Fluke 87 digital multimeters to make the measurements. On the inverter's input side, we used the Beckman 2020 to measure input voltage and a Fluke 87 (in 4 digit mode) to measure current via a 500 Ampere, 50 milliVolt. Deltech shunt. The inverter's 120 vac output voltage was measured in rms and peak modes by two Fluke 87s. The inverter's output current was run through a Fluke 87 for measurement.

The Test Data

This is the data just as we took it. Over the last seven months I had come to suspect that the Exeltech was very stable because it never even hiccuped. The data we took was astounding!

The rms and peak voltages of this inverter are rock solid. By definition, 60 Hz sine wave power should have an rms voltage of 117 vac. The peak of this sine wave has a voltage of 164 volts peak. From no load to 1200 watts, the inverters output voltage changed by

only 0.8 volts rms. The peak output voltage varied only 1.2 volts from no load to 1200 watts output. This is the most stable performance we have ever seen from any inverter.

After making the test measurements, we put a Hewlett-Packard AN/USM-339 oscilloscope on the inverter's output. Sam, Bob-O, and I ran around the house turning on and off the nastiest loads — like the 800 watt microwave oven, and the 600 watt swamp cooler blower. The trace on the oscilloscope remained a pure, smooth sine wave regardless of the load. We used the oscilloscope to zoom in on a portion of the waveform. We were looking for glitches, overshoot, undershoot, and general noise. We couldn't find any. According to Exeltech, the output sine wave is synthesized at 25 kHz. This means that each sine wave is broken down into about 416 pieces. Whatever the folks at Exeltech are doing is definitely working — this inverter's waveform is as smooth as a baby's butt.

Exeltech SI1000 Inverter

Date: 29 December 1993

Serial #: 100055

INPUT DATA

ON THE 12 VDC SIDE

Battery Volts	Amps IN	Watts IN
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OUTPUT DATA

ON THE 120 VAC SIDE

Vpp OUT	Vrms OUT	amps OUT	watts OUT	Eff %
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15.18	0.8	12.1	166.4	118.4	0.00	0.0	
15.09	2.5	37.7	166.4	118.4	0.20	23.4	62.1%
15.06	3.8	57.2	166.4	118.4	0.34	39.8	69.5%
15.05	5.1	76.8	166.4	118.4	0.51	59.8	77.9%
15.07	6.8	102.5	166.4	118.3	0.70	83.0	81.0%
15.08	8.0	120.6	166.4	118.3	0.84	99.1	82.2%
14.98	9.8	146.8	166.0	118.3	1.03	122.3	83.3%
14.84	12.2	181.0	166.0	118.3	1.28	151.8	83.8%
14.99	13.9	208.4	165.4	118.3	1.48	174.8	83.9%
15.03	22.9	344.2	166.0	118.2	2.45	289.7	84.2%
14.97	30.7	459.6	166.0	118.1	3.28	386.8	84.2%
14.90	36.8	548.3	166.0	118.1	3.91	461.3	84.1%
14.85	47.2	700.9	165.2	118.0	4.99	588.8	84.0%
14.73	60.4	889.7	166.0	117.9	6.27	739.2	83.1%
14.62	72.7	1062.9	165.2	117.9	7.41	873.6	82.2%
14.54	81.7	1187.9	165.2	117.8	8.22	968.3	81.5%
14.36	89.6	1286.7	165.6	117.7	8.87	1044.0	81.1%
14.42	100.3	1446.3	164.8	117.6	9.84	1157.2	80.0%
14.11	111.6	1574.7	165.2	117.6	10.59	1245.4	79.1%
Averages to 1000 Watts			165.9	118.2			

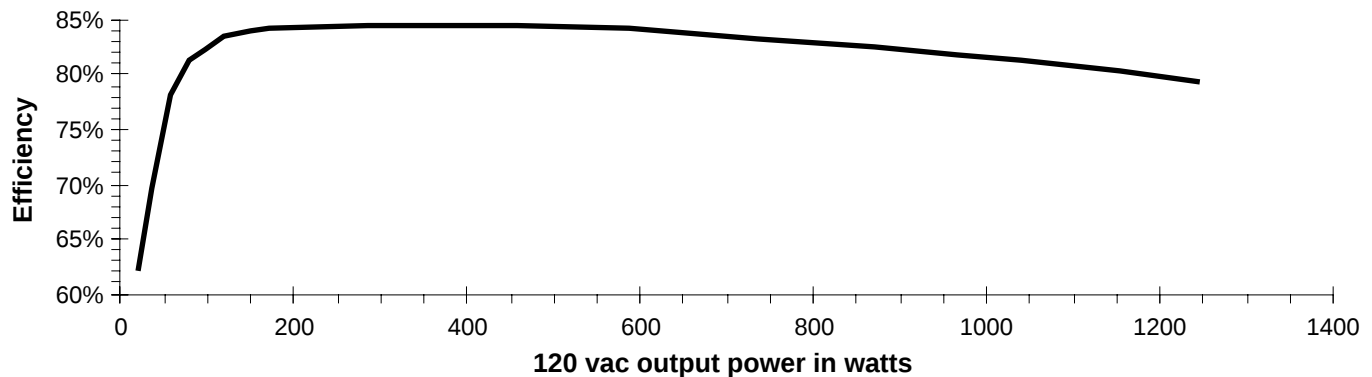
During the last seven months we have inadvertently overloaded the SI 1000 at least six times. It protected itself and shut off. During this round of testing we operated 1250 watts of lights on the SI 1000 for ten minutes. In my estimate, this inverter is very conservatively rated. The SI 1000 is a very quiet inverter, both to the ear and to radios. The only audio noise is the operation of the SI 1000's thermally activated cooling fan. We measured the inverter's no load power consumption at 12.1 watts which is very low for a sine wave inverter.

I was going to do graphs of the inverter's output rms and peak voltages verses its power output, but the graphs were boring straight lines — the rms and peak voltages don't vary. Instead I'll graph this inverter's least attractive feature, its efficiency.

Efficiency

While sine wave inverters produce cleaner power, they do so at a price — efficiency. The SI 1000 showed efficiency over 81% from 75 to 1000 watts output. This is about ten percent less efficient than a typical modified sine wave inverter of the same output power. In our case, the added inefficiency is more than balanced by the cleaner power. I figure that in our system it costs us the energy produced by two PV modules to support this additional ten percent inefficiency.

Exeltech 1000 Sine Wave Inverter — Efficiency vs. Output Power



Where to use the Exeltechs

Anywhere that a modified sine wave inverter is too noisy or its power is too dirty. Some devices, like laser printers and magneto optical hard drives require sine wave power. Almost every appliance will run quieter and in most cases cooler on sine wave power — it's what they're built to digest. Many home-powered, home businesses use computers. We know inverters are powering publishing companies, video editing suites, and recording studios. Just about everyone has video and audio equipment. Inverter-produced noise, both audible noise and distortion on the inverter's power output, can be a very real problem. In the case of *Home Power's* system, we are overjoyed not to hear the inverter on our radiotelephone system. Changing over to sine wave power has increased the modem's speed from 1200 baud to 4800 baud over our radiotelephone. We have become accustomed to a clean picture on the TV. It's easy to get spoiled.

Conclusion

At a price of \$1,190, Exeltech's SI 1000 is an outstanding value. Many systems will continue to operate modified sine wave inverters successfully. Sine wave models are more expensive to buy and operate than modified sine wave inverters. But if the cleaner, more stable power is worth the extra expense, then this is the inverter to use.

Access

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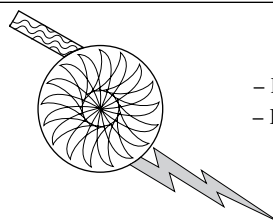
Inverter's Maker: Exeltech, 2225 East Loop 820 North, Fort Worth, TX 76118 • 800-886-4683 • 817-595-4969 • FAX 817-595-1290



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